Dragos 2026 OT Cybersecurity Report

Year in Review, O&G and Petrochemicals Focus

DRAGOS

Mike Hoffman

Field CTO, Oil & Gas and Petrochemicals

linkedin.com/in/mjhoffman7

- 26 years of experience across automation and ICS/OT security, with roles in O&G downstream, upstream, and global technical leadership
- Past titles have included Principal Consultant, Principal ICS Security Engineer, Controls & Automation Specialist, Process/CEMS Analyzer Specialist, and Instrumentation & Electrical Technician
- Certified SANS Instructor ICS410/ICS612, GSE #320, Master's in Information Security Engineering from SANS Technology Institute

Middle East Developments

Kinetic Attacks impact to the global O&G and Petrochemical markets

- Qatar LNG assets have been impacted and have declared Force Majeure. Over 17% reduction in global LNG output
- Bahrain Refinery production was affected due to a drone strike, and has declared Force Majeure
- Kuwait Refineries are at reduced capacity and have declared Force Majeure
- Saudi Arabia's refineries targeted
- UAE Refineries, Gas Fields, and Oil Terminals targeted
- Oman Oil Terminas targeted
- Strait of Hormuz shipping lane effectively blocked – affecting 20% of global oil supply

Middle East Developments

Cyber Attacks

What is going on

- Considerable amount of GPS attacks around the Strait of Hormuz
- Reported Adversarial activity and data exfiltration in LNG companies
- BAUXITE claimed Jordanian wheat silo compromise
- MuddyWater increased activity against the US. Israel (historically targeting the EU, but it's shifting focus to the US and Israel)
- Hacktivism is on the rise (claims have doubled since the start of the war)

How to be ready

- Expect Stage1 Activity
  - Primary Operational Risk
- Adversaries Will Target Exposed ICS/OT Assets
  - Eliminate or lock down internet-facing devices
- Prepare for Manual Operations
  - Ensure you have offline tested backups
- Expect & Accept Hacktivist Noise
  - DDoS campaigns, exaggerated claims of operational disruption

9th Annual Dragos Year in Review

New specialized threat groups with diverse approaches lower the barrier for established groups to achieve OT impact

Control loop mapping demonstrates **adversaries understand industrial operations at the process level**

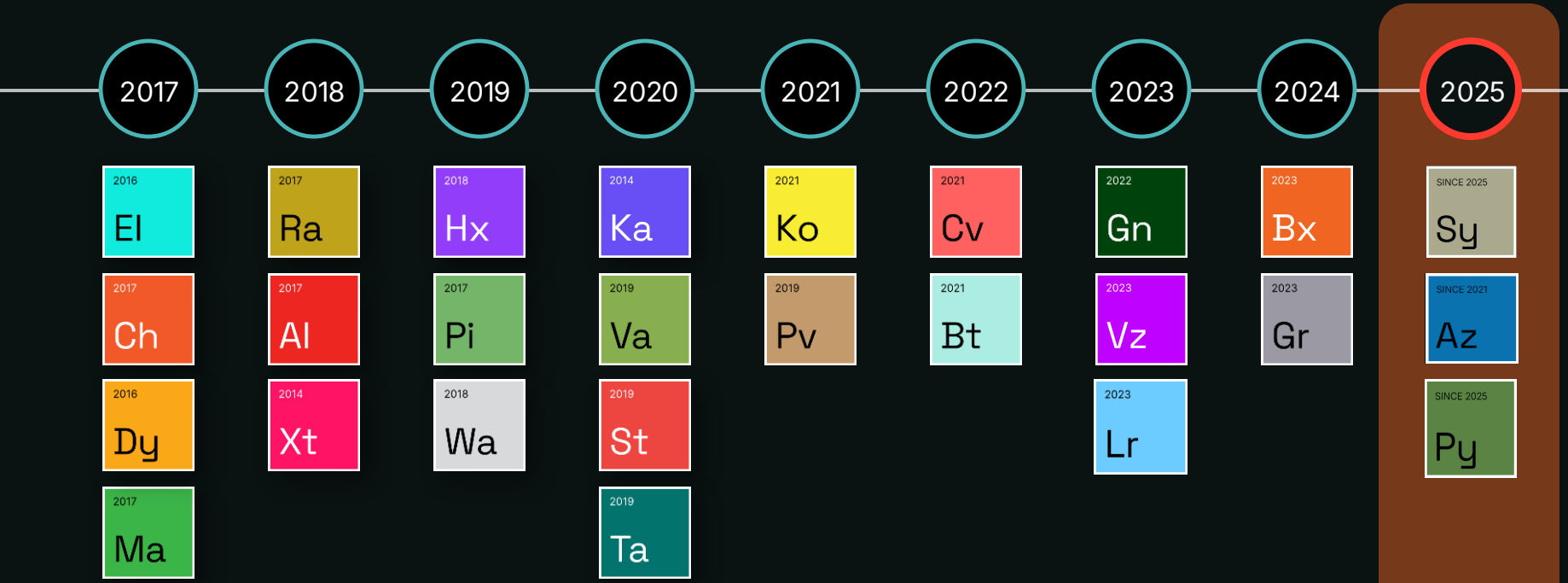
Shift from reconnaissance to **attempted operational effects throughout 2025**

Ransomware incidents are OT by consequence despite frequent oversimplification and mislabeling

Organizations still struggle to implement basic controls, preventing an effective response when attacks occur

Dragos Identifies 3 New Threat Groups

Of the 26 threat groups tracked by Dragos, 11 were active in 2025



New: SYLVANITE

Rapid exploitation broker enabling VOLTZITE access to critical infrastructure

SINCE 2025

Sy

- Exploited Ivanti VPN vulnerabilities within 48 hours of disclosure
- Extracted Active Directory credentials
- Installed persistent web shells on F5 devices
- Handed off access to VOLTZITE or deeper intrusions

Targets:

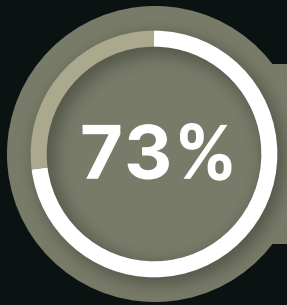

Electric Power


Water


Oil & Gas


Manufacturing


Public Administration



of Dragos IR cases involved active exploitation or credential reuse of VPN/jumphosts

Overlaps with: UNC5221, UNC5174, UNC5291, UNC3236, HOUKEN, Red Dev 61, CL-STA-0048, UTA0178

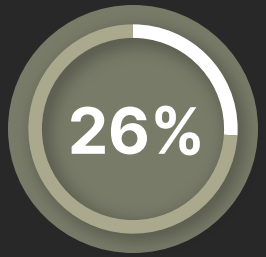
Rapid Vulnerability Exploitation Campaigns

Dec 2023 (1)
Ivanti Connect Secure CVE-2023-46805, CVE-2024-21887

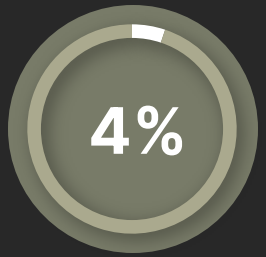
2024 (2)
F5 BIG-IP & ConnectWise ScreenConnect; F5: CVE-2023-46747; ConnectWise: CVE-2024-1709

Apr 2025 (3)
SAP NetWeaver Zero-Day CVE-2025-31324

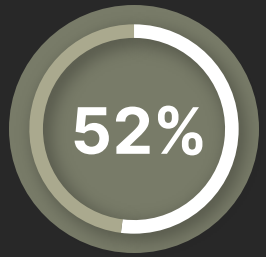
May 2025 (4)
Ivanti EPMM (U.S. Utility Victim) CVE-2025-4427, CVE-2025-4428



of advisories had NO patch when announced



had public POC & were actively exploited



Dragos provided alternate mitigations when vendors couldn't

VOLTZITE

Demonstrated capability to access
& manipulate OT/ICS assets

- Exploited VPN gateways to access utility networks
- Extracted SCADA configuration files from engineering workstations
- Observed operational data to understand process shutdown conditions
- Maintained access through web shells on internet-facing appliances

Overlaps with: VOLT TYPHOON, BRONZE SILHOUETTE, VANGUARD PANDA, INSIDIOUS TAURUS

VOLTZITE Attack Path

01 Network perimeter reconnaissance

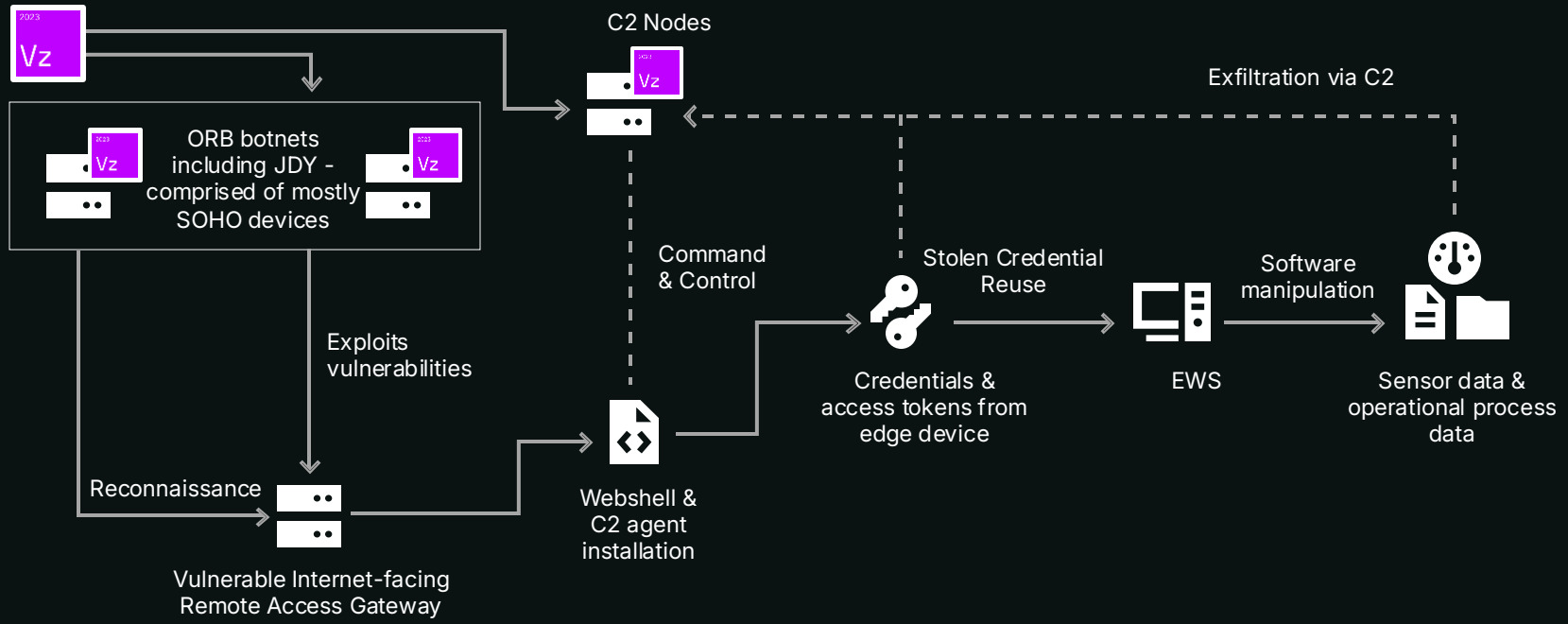
02 Compromise Internet-facing edge devices

03 Establish edge device persistence

04 Exfiltrate credential data from internet-facing edge devices

05 Replay legitimate credentials for lateral movement

06 Exfiltrate OT sensor and operational process data



New: AZURITE

Theft of operational information, long-term access enablement

What Dragos Observed in 2025

- Compromised SOHO routers to build proxy infrastructure across multiple countries
- Exfiltrated OT network diagrams and operational data
- Accessed engineer workstations through compromised edge devices
- Maintained persistent access for extended periods using living off the land techniques

Targets:

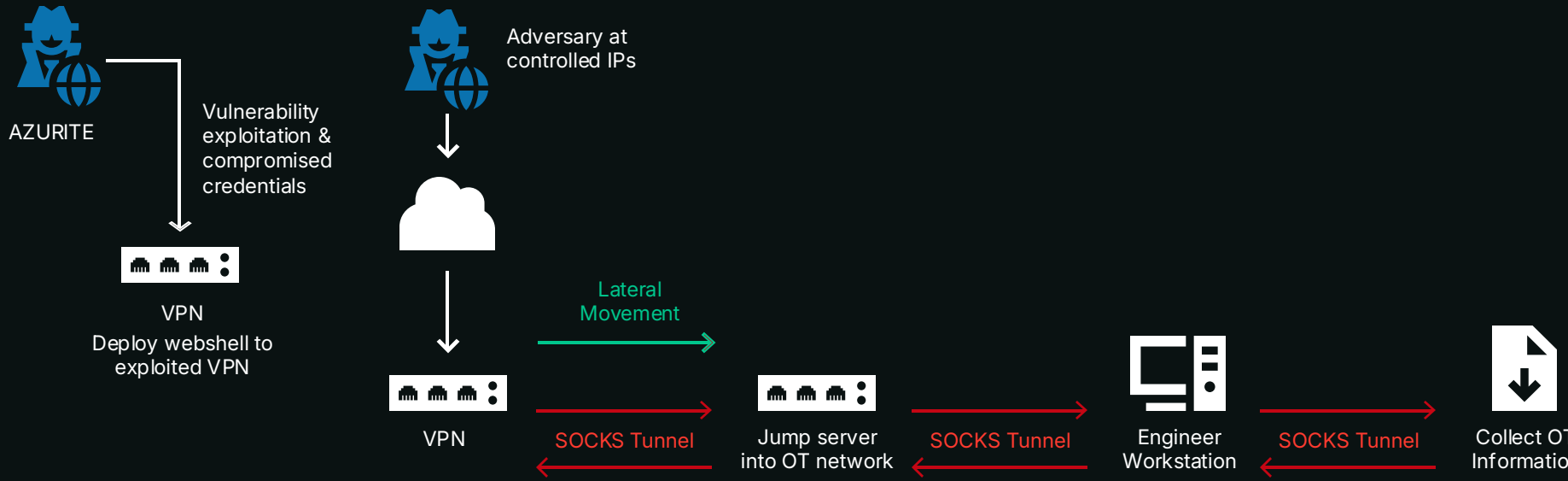
Manufacturing | Defense | Automotive | Electric | Government | Oil & Gas

Overlaps with: Flax Typhoon, Ethereal Panda, UNC5923, Raptor Train, Red Dev 54

AZURITE

VPN Access to OT Environment and Engineer Workstation

01	02	03	04	05
Exploit vulnerabilities or use VPN credentials from other credential stuffing	Deploy webshell to VPN device	Access OT jump server with compromised credentials	Access engineer workstation to exfiltrate OT operational information	Exfiltrate alarm data, PLC configurations, HMI data, operational information via SOCKS tunnels



AZURITE

SOHO Device Compromise to Achieve OT Access

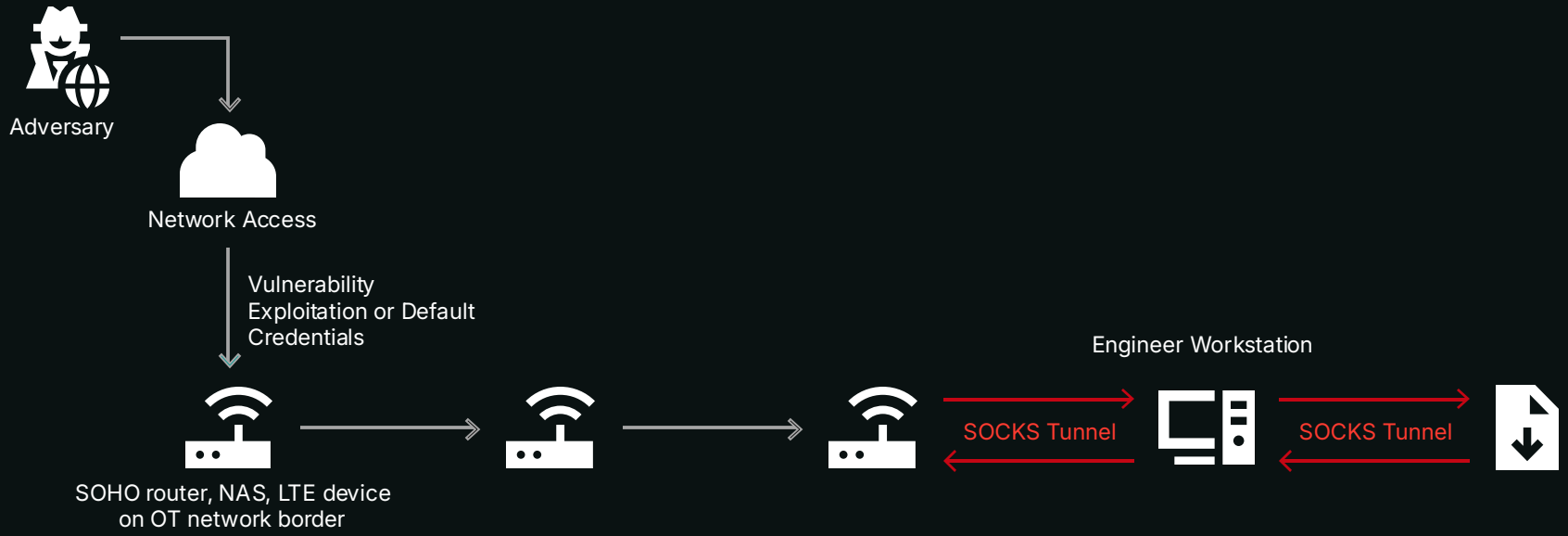
01 Direct access to exposed SOHO devices

02 Enroll device into ORB network and/or stage capabilities on ORB

03 Pivot into OT network segment connection with the edge device

04 Identify and then access engineering workstations

05 Exfiltrate alarm data, PLC configurations, HMI data, operational information via SOCKS tunnels



New: PYROXENE

Cross-domain access enabling movement from IT into OT networks

SINCE 2025

Py

What Dragos Observed in 2025

- Created fake LinkedIn profiles posing as aerospace recruiters
- Used stolen credentials to access Citrix and VMware systems
- Compromised defense contractor websites to target employees
- Moved from corporate IT into operational technology networks

Targets:

Transportation | Logistics | Aerospace | Aviation | Utilities | Manufacturing

Overlaps with: APT35, Tortoiseshell, UNC1549, Imperial Kitten, assessed by the U.S. Government to be aligned with the Islamic Revolutionary Guard Corps Cyber Electronic Command (IRGC-CEC)

PYROXENE Attack Path

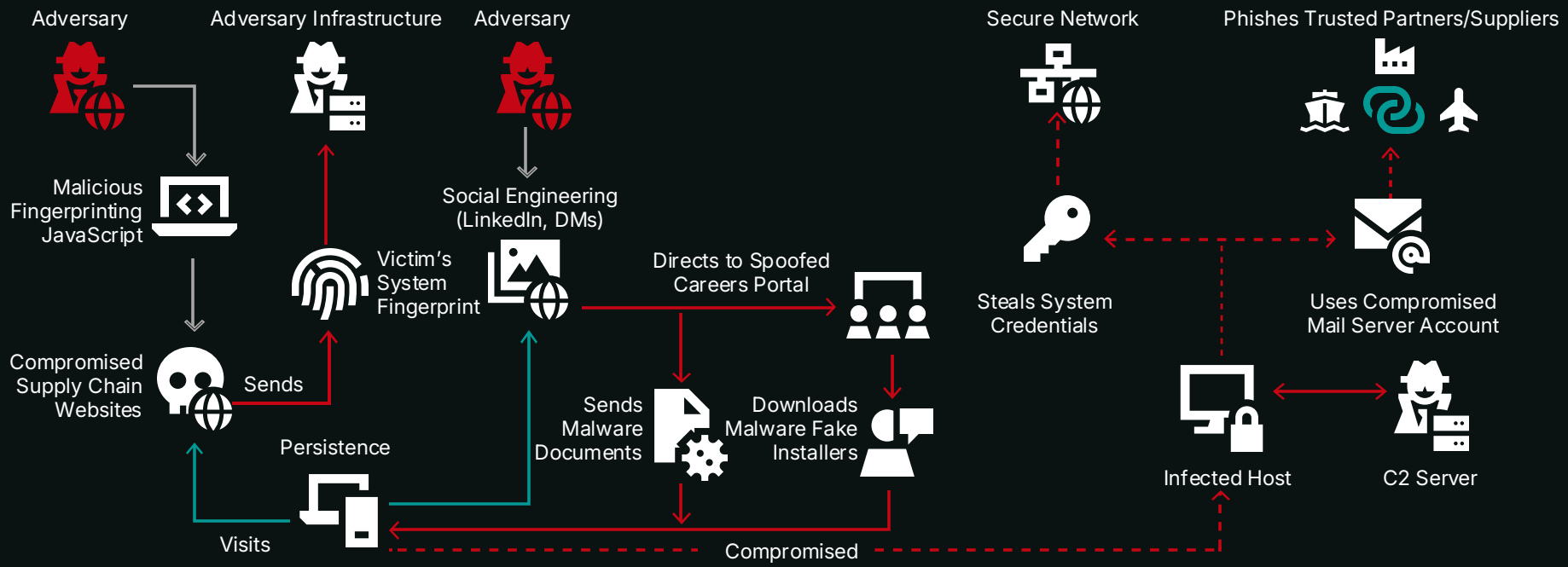
01 Strategic website compromises

02 Social engineering campaign

03 Deploy RAT/Backdoor Infect Victim Host

04 Lateral movement into secure network

05 Supply Chain Attack



Expansion of KAMACITE Targets

Targeted reconnaissance & access establishment enabling ELECTRUM attacks

- European supply chain campaign targeting 25+ Ukrainian ICS vendors and GIE conference attendees with multi-week social engineering
- U.S. reconnaissance scanning industrial devices:
  Schneider Altivar VFDs, Smart HMIs, Accuenergy AXM modules, Sierra Wireless AirLink gateways
- Industry-specific phishing using native languages and technical terminology
- Hands off established access to ELECTRUM for destructive Stage 2 operations

Systematic Targeting of Operational Workflows

KAMACITE U.S. Campaign (March-July 2025)

Targeted

- HMIs (command origin)
- VFDs (physical control)
- Meters (process visibility)
- Gateways (remote access)

Also Observed:

VOLTZITE: Dumps configs to find process stop triggers

AZURITE: Exfiltrates alarm data for operational boundaries

Adversaries are mapping entire control loops for future targets & attacks.

ELECTRUM: 10 Years of Practice

From manual breaker commands to automated grid attacks

December 2015

1

Coordinated attack on 3 Ukrainian distribution operators causing power outages during winter

December 2016

2

Deployed CRASHOVERRIDE malware against Ukrainian transmission substation affecting hundreds of thousands

2022-2025

3

Deployed Industroyer2, LOTL scripts targeting distribution automation, and multiple custom wipers

still can't detect Electrum-style attacks

BAUXITE

Direct ICS manipulation and destructive operations targeting internet-exposed operational technology

2023

Bx

What Dragos Observed in 2025

- Threatening email campaign targeting cybersecurity vendors, ICS researchers, and media
- Deployed two wiper malware variants against Israeli targets during Iran-Israel conflict
- Continued Stage 2 activity: Direct manipulation of internet-exposed HMIs, PLCs, and industrial devices

Targets:

Critical infrastructure globally, with focus on organizations with internet-exposed OT devices

Overlaps with: CyberAv3ngers (hacktivist persona)

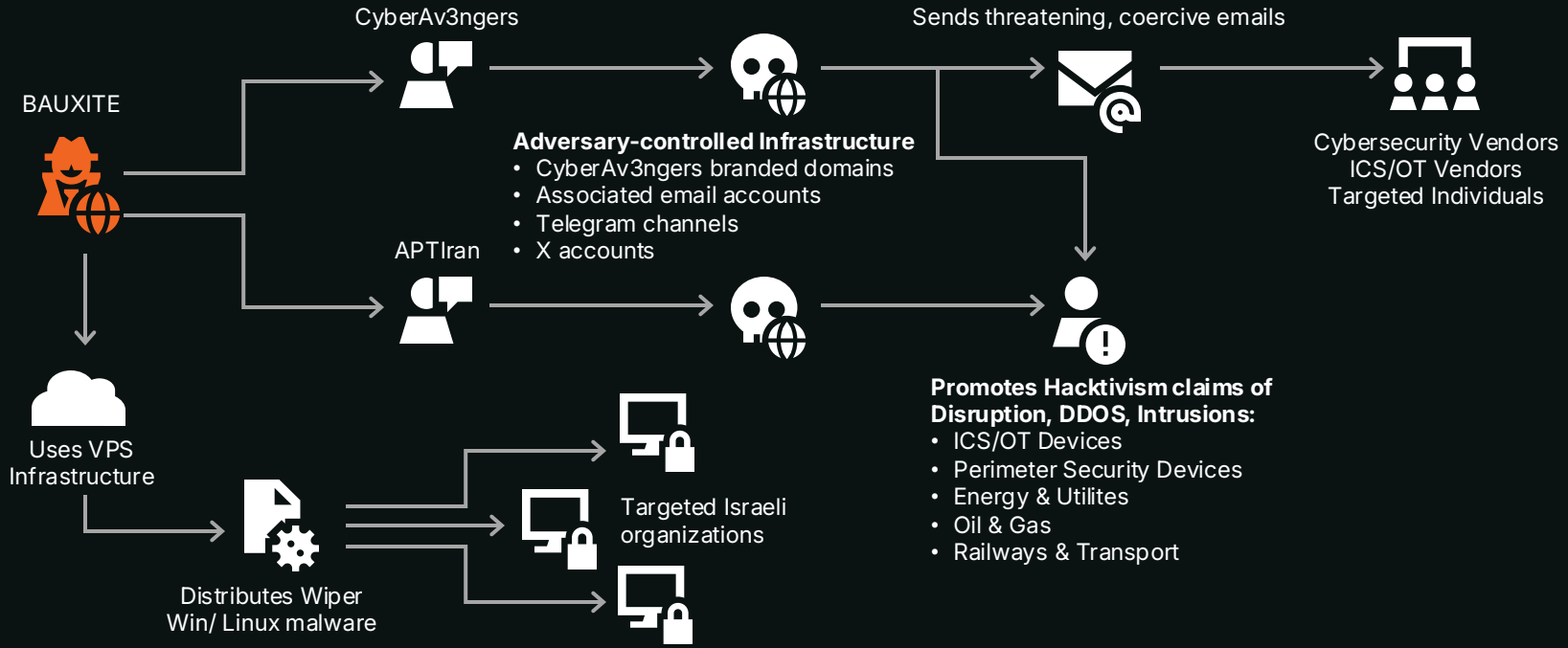
BAUXITE 2025 Activity

01

Psychological, Influence Operations

02

Destructive attacks against Israeli targets



Root Cause Analysis Problem

You can’t determine root cause if you lack monitoring BEFORE the incident.

30%

of IR cases began with “something is wrong”

82%

lack criteria for when operational anomalies trigger cyber investigation

Is it cyber?
Is it mechanical?
Is it operator error?

Many attacks don’t look like cyber

They’re just operational misuse of legitimate equipment

VOLTZITE config dumping looks like troubleshooting

KAMACITE VFD scanning looks like standard system enumeration

AI Compounds the Visibility Problem

Establish visibility BEFORE deploying AI or risk creating exponentially greater blind spots.

Organizations are deploying

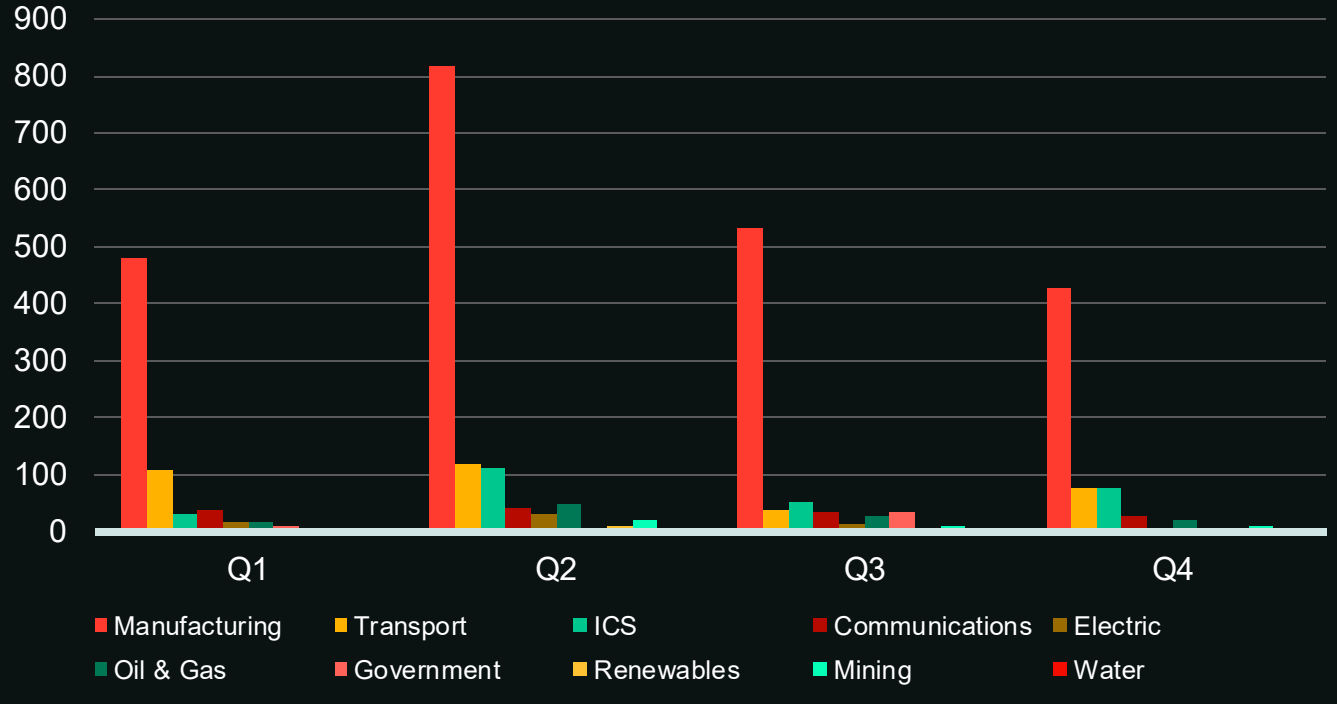
in operational environments without first establishing visibility.

> Was this cyber, equipment failure, AI error, or authorized change?

Impossible to answer without OT visibility & foundational telemetry already in place beforehand

Ransomware by Sector

In 2025, 3300 ransomware attacks targeted industrial organizations



5 days
average dwell time
(getting faster)

Ransomware in OT is Mislabeled as IT Problem

Don’t call it an IT breach if OT stops working

If you classify by operating system, you miss the operational impact.

If you classify by network segment, you miss IT/OT dependencies.

Classify by consequence:
Did operations stop? It's an OT incident.

> **“It only hit Windows systems.”**
>
> *Engineering workstations run Windows. HMIs run Windows. Historians run Windows.*

The State Of ICS/OT Vulnerabilities

15% of vulnerabilities Dragos assessed in 2025 had incorrect CVSS data

More Severe CVSS

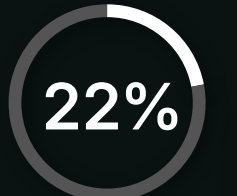
Less Severe CVSS

The Same

52% of advisories required Dragos to provide mitigations vendors didn't

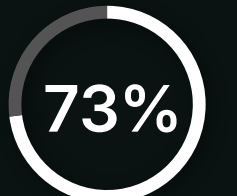
Where Vulnerabilities Reside

VULNERABLE ASSETS BORDERING THE ENTERPRISE ARE EXPLOITED FOR INITIAL ACCESS

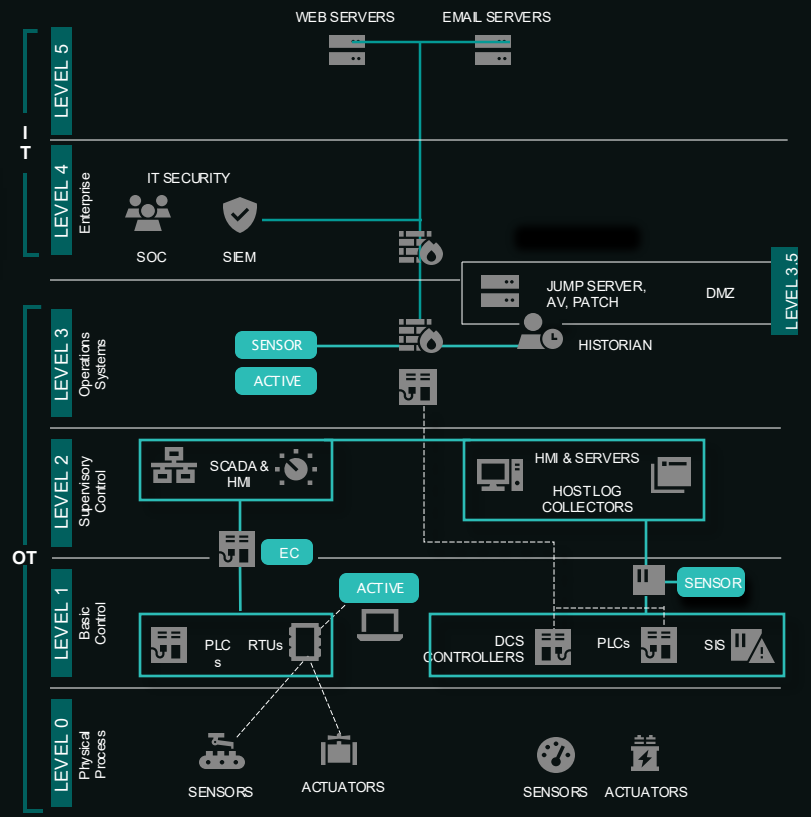


LEVELS
3.5 | 4 | 5

VULNERABLE ASSETS DEEP WITHIN ICS NETWORKS ARE CLOSE TO CRITICAL PROCESSES



LEVELS
0 | 1 | 2 | 3



Necessity of Risk-Based Decision

Only some vulnerabilities need immediate action

of ICS/OT vulnerabilities

needed to be addressed

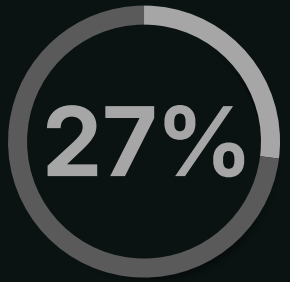
NOW

are network exploitable with no direct operational impact

These need to be addressed

NEXT

Mitigate through network monitoring, segmentation & MFA



pose a possible threat but rarely require action

They likely never need to be addressed

NEVER

Monitor these for signs of exploitation

Defenders Can’t Keep Up

Findings from pentests, tabletop exercises, assessments, and incident response

Can't **See** Fast Enough

have no OT visibility, impeding root cause analysis

detected ANY red team activity below IT/OT boundary

Can’t **Respond** Fast Enough

TTX struggled to detect & respond before process impact

recovery times

Active Threat Groups

Who is targeting oil and gas – and how?

VOLTZITE

Stage 2

Upgraded to Stage 2 — targeting pipeline operations

Compromised Sierra Wireless Airlink gateways across U.S. midstream, upstream, and downstream pipeline operations. Pivoted to engineering workstations to dump config files and alarm data - mapping what triggers operational processes to stop.

‣ Sierra Wireless Airlink RV50/RV55 exploitation ‣ Sensor and operational data exfiltration from OT ‣ JDY botnet pre-staging VPN appliances across O&G

AZURITE

Stage 2

Stealing O&G operational data to enable future attacks

Targets oil and gas engineering workstations to exfiltrate alarm data, config files, and process information. Not disrupting now, collecting the intelligence needed to develop OT-specific attack capability later.

‣ Exploits internet-facing Ivanti, Fortinet, and F5 devices ‣ RDP access to EWS using compromised credentials ‣ Data staged outside OT network via SOCKS5 tunneling

SYLVANITE

Stage 1

Initial access provider targeting O&G at scale

Targets O&G across North America and Saudi Arabia. Exploits internet-facing edge devices and passes access to VOLTZITE within days. Port scanning alone has caused unintended disruption to legacy OT devices.

‣ N-day exploitation of F5, Ivanti, SAP, and ConnectWise ‣ Credential harvesting; lateral movement via SOCKS5/FRP ‣ Passes access to VOLTZITE for follow-on OT operations

KAMACITE

Stage 1

Mapping U.S. energy infrastructure to prepare ELECTRUM for operations

Between March and July 2025, KAMACITE conducted sustained reconnaissance of U.S. internet-exposed industrial devices — targeting HMIs, VFDs, meters, and cellular gateways in sequence to map entire control loops. O&G infrastructure was directly in scope. KAMACITE's mission is building persistent access for ELECTRUM to operationalize.

‣ Systematic scanning of exposed HMIs, VFDs, meters, and Airlink gateways ‣ Spear-phishing of operators, vendors, and integrators ‣ Passes persistent access to ELECTRUM

Oil & Gas Sector Risks

Key threat themes converging on oil & gas operations in 2025-2026

01

CELLULAR GATEWAY EXPLOITATION

Your most exposed OT entry point is a device IT doesn't know exists

VOLTZITE compromised Sierra Wireless Airlink gateways across midstream, upstream, and downstream pipeline operations. These cellular routers create unauthorized OT pathways, bypass traditional security controls, and are often invisible to IT teams. Once inside, VOLTZITE pivoted to engineering workstations to map what triggers process shutdowns.

02

OT INTELLIGENCE COLLECTION

Adversaries are building the capability to attack oil & gas

AZURITE targets O&G engineering workstations to exfiltrate alarm data, configuration files, and process information. This is not disruption — it is the preparation for disruption. The data stolen today almost certainly supports developing OT-specific attack tooling for future physical-consequence operations.

03

ACCESS-PROVIDER ECOSYSTEM

Ransomware reaches OT without touching a single industrial protocol

Affiliates authenticate into VPN portals using stolen credentials, pivot to ESXi hypervisors hosting SCADA and historian VMs, and encrypt. Operations lose visibility and control without any ICS-specific exploit. 73% of Dragos IR cases involved VPN or credential reuse as the entry point, and O&G has the highest rate of default credentials of any sector.

OPERATIONAL CONSEQUENCES

Loss of View

Stolen config files and alarm data give adversaries the intelligence to cause process disruption while operators lose trust in their own telemetry.

Loss of Control

VOLTZITE specifically mapped what triggers pipeline processes to stop. That intelligence enables targeted disruption of operations when an adversary chooses to act.

Physical Impact

Ransomware encrypting OT-support hypervisors causes multi-day operational shutdowns. 100% of Dragos OT ransomware cases in 2025 resulted in significant operational disruption.

THE FIVE ICS CYBER SECURITY CRITICAL CONTROLS

RECOMMENDATIONS

01 ICS Incident Response Plan

02 Defensible Architecture

03 ICS Network Monitoring Visibility

04 Secure Remote Access

05 Risk-based Vulnerability Management

Field Data, TTX Results & Priority Actions for Oil & Gas Operators

⚠ O&G TTXs show Major Challenges in COMMUNICATE, CONTAIN, and DOCUMENT

When incidents occur, O&G operators struggle to coordinate, stop, and record what happened.

2025 TTX RESULTS — OIL & GAS SECTOR

Dragos tabletop exercise performance across OT incident response capabilities

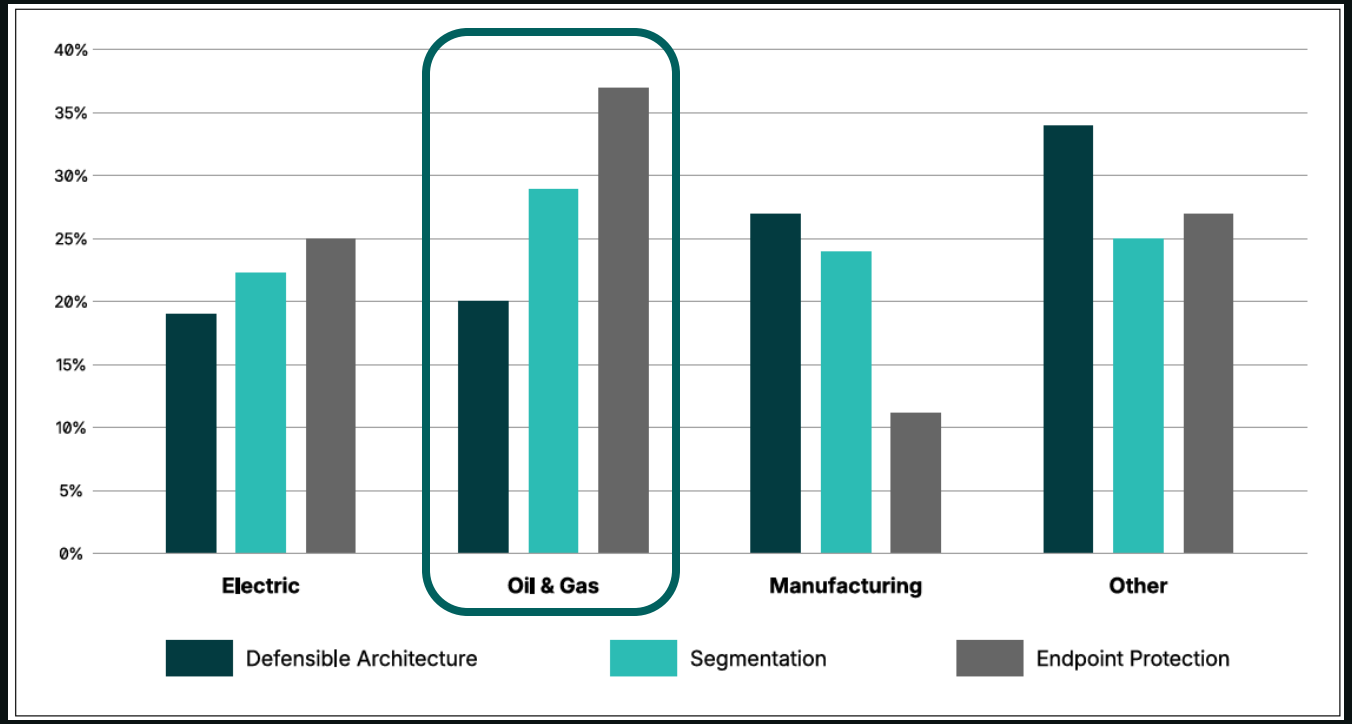
Activate	Some Challenges
Detect	Some Challenges
Respond	Some Challenges
Communicate	MAJOR Challenges
Recover	Some Challenges
Contain	MAJOR Challenges
Document	MAJOR Challenges

PRIORITY ACTIONS FOR O&G OPERATORS

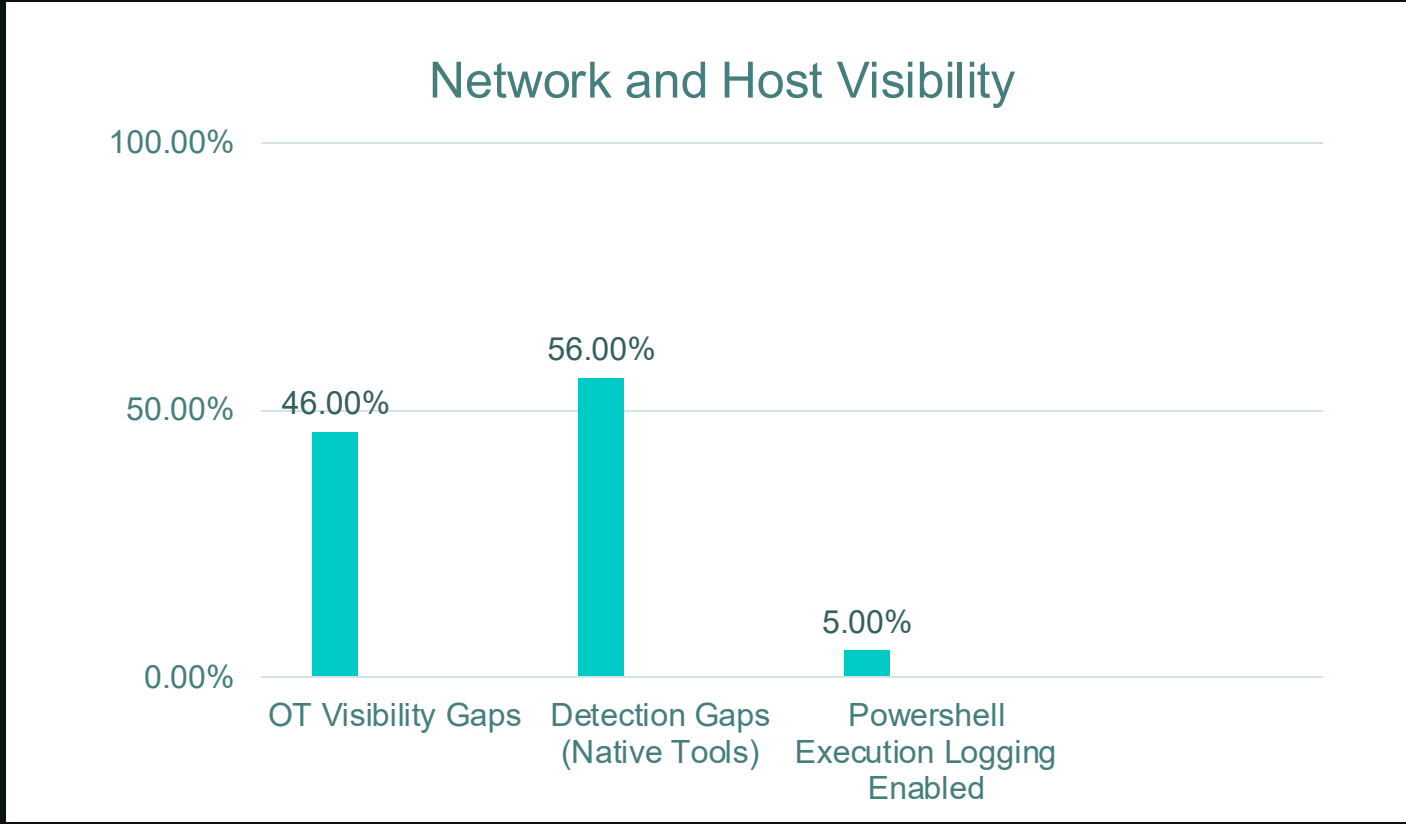
1. **Audit every Sierra Wireless Airlink gateway**
   VOLTZITE specifically targeted these across midstream, upstream, and downstream. Many O&G operators will find gateways IT didn't know existed.
2. **Remove default credentials on field devices**
   26% of O&G sites still have them. Ransomware variants Fog and Greenlux exploited exactly these weaknesses in 2025.
3. **Segment OT from IT - especially vendor access**
   29% of O&G reports found poor IT/OT segmentation. Flat architectures allowed ransomware to move laterally without resistance in 2025.
4. **Deploy ICS-aware monitoring on SCADA and historians**
   AZURITE operated inside O&G OT environments undetected. 46% of architecture reviews found significant visibility gaps in O&G.
5. **Exercise O&G-specific incident response playbooks**
   TTXs show Major Challenges in three of seven core IR capabilities. Practice coordinated IT/OT response before an incident forces it.

Field Data, Defensible Architecture Stats

⚠ O&G is still struggling with basic controls

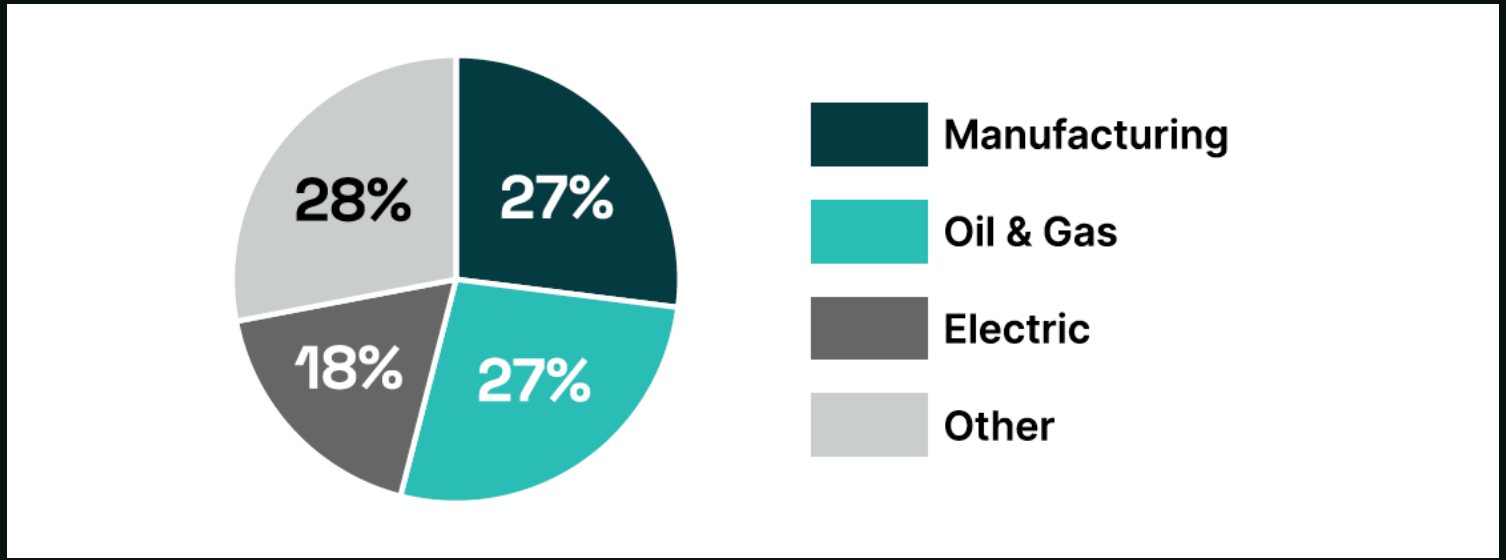


Field Data, OT Visibility Stats (All Engagements)



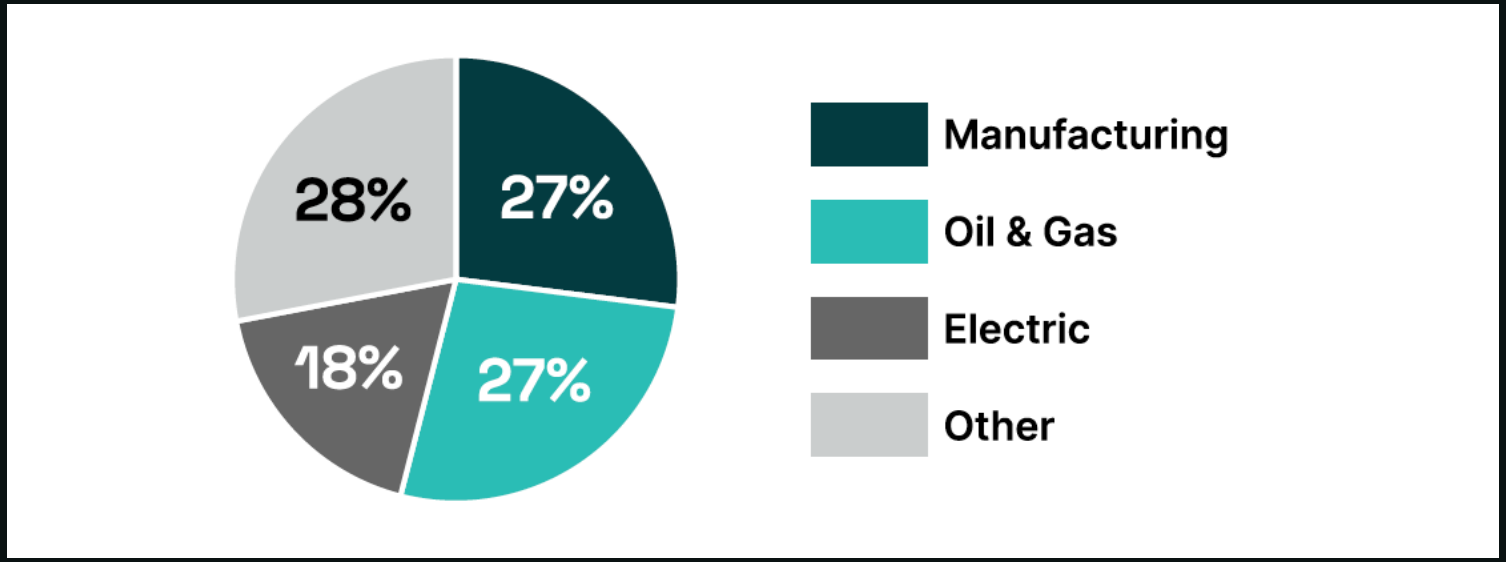
Field Data, Secure Remote Access

⚠ 50% of engagements included SRA findings



Field Data, Vulnerability Findings

⚠ 80% of engagements included vulnerability findings



QUESTIONS AND ANSWERS

Thank you